RESEARCH DEVELOPMENTS AT

THE U. S. COTTON GINNING LABORATORY

By

Chas. A. Bennett, Senior Mechanical Engineer
Bureau of Agricultural Chemistry and Engineering

and

Francis L. Gerdes, Cotton Technologist
Agricultural Marketing Service

(Presented by the Senior author before a meeting of the Georgia Cotton Ginners Assn., May 9, 1940)

The research program of the United States Cotton Ginning Laboratory, Stoneville, Mississippi, at the present time is divided into two parts -- one dealing with harvesting, handling, conditioning, cleaning, extracting methods and saw and roller ginning processes, and the other with pressing and packaging bales to higher densities at the gin. Each project requires a staff of specialists, which for the engineering responsibilities are provided by the Bureau of Agricultural Chemistry and Engineering, and for the quality and marketing phases are provided by the Agricultural Marketing Service. In the Washington activities for the latter Service, the quality activities concerned with ginning are a part of the program of Cotton Quality and Standardization Research, under the leadership of R. W. Webb, and the economic and quality aspects of packaging are headed by John W. Wright; while at Stoneville, both are handled by Francis L. Gerdes.

The cotton farmer benefits directly by good ginning. The ginner must obtain a reasonable profit for his services if he is to continue to provide them; and to this end the research and development program of the U. S. Cotton Ginning Laboratory is designed to improve the quality of American cotton, and as such is in the interest of both the producer and the ginner, because they have a mutual interest in the cotton enterprise.

The equipment requirements of today's gin must conserve power, embrace simplified machinery suitable to regional needs and afford certain other necessary features with which the grower is vitally concerned.

In the light of our present outlook on the industry, a modern gin should include such features as a conditioner or drier, a pure seed handling system, adequate cleaning and extracting machinery, economical fans and piping, and a suitable packaging outfit.

In the 1939 ginning season almost 1,100 out of the 11,884 gins in the United States operated driers, of which 30 were in Georgia. From reports furnished by ginners operating driers in these states during the 1939-40 ginning season, it was found in calculations made at the Laboratory that bale enchancements averaged $4.42 a bale on damp or wet cotton

and $1.23 a bale on dry cottons, as a result of conditioning and cleaning cotton with drying equipment.. This is a valuable service to Georgia cotton farmers.

The driers also showed relative capacity increases of 28 percent and 4 percent respectively for these respective groups of cottons. The operating costs of the driers averaged only 28 cents per bale in Georgia, and those gins which had driers reported a significant increase in their volume of business.

The United States Cotton Ginning Laboratory is revising its Bulletin No. 239, on Vertical Driers for Seed Cotton, in order to describe recent forms of tower driers. Low towers appear to predominate among new forms of tower drier installations and include those set over cleaners, pressure delivery outfits, and Lambert-type supply systems whose draw-through features neutralize separator leaks in old gins. While awaiting the printing of the new bulletin, ginners are invited to write to the U. S. Cotton Ginning Laboratory or to Mr. J. C. Oglesbee, Extension Agricultural Engineer, Georgia Agricultural Extension Service, Tifton, Georgia, regarding any of these systems which may interest them.

Pure seed handling methods are rapidly gaining recognition. Single variety communities are not the only ones which profit from this. At the Ginning Laboratory self-cleaning belts and seed blowing systems are both used, and in some of the cooperating two-story gins, the bottoms of the seed auger troughs have been hinged so that little labor is involved in cleaning out the gin for handling even single bales for planting seed. Much interest also centers about work now under way with rotary blowers instead of fans for reducing the horsepower in handling seed. Pure seed blowing systems at the Stoneville Laboratory have been set up with pipes which are smaller than those now generally in use, and indicate that one horsepower per gin stand does the work with a blower and that even with fans instead of blowers, energy required for handling seed per gin stand should not exceed two horsepower.

Cleaning and extracting problems differ with regions. As rapidly as our research program will permit, regional surveys are being made at typical cotton gins across the entire Belt to study power consumption, cleaning, extracting, pressing and other aspects of the ginning process.

In the southeastern states many ginners cannot afford to install both unit extractor feeders and huller/gin stands. Under such circumstances if the existing plain gins are in good condition, the purchase of the extractor feeder is most advisable, because it does more cleaning and extracting than the huller fronts, and the ginner can still keep the seed rolls clean by frequent dumping.

Huller gins provide clean seed rolls which are very necessary in preventing the saws from cutting up and "peppering" trash into the lint. The seed rolls of plain gins quickly accumulate leaves, stems and sticks, so that their dumping at regular intervals must be done.

In the last 30 years extensive improvements in the design and construction of cleaning and extracting machinery used prior to ginning have been made. Unfortunately, the adoption and use of this equipment has not been as complete in some parts of the Cotton Belt as in others. Gins in West Texas and West Oklahoma where a great deal of the cotton is pulled or "snapped" are nearly all equipped with elaborate cleaning machinery, and in the central and Mississippi Valley states the cleaning facilities are much less. In the Southeastern sections the majority of gins are operated with a minimum of machinery requirements, although there has been some progress made in the last decade in the Carolinas, Georgia and Alabama. In 1930 less than 5 percent of gins in these states were equipped with extractor feeders, 20 percent in 1935, and over 25 percent at the present time.

The increased production of long staple cotton in one variety communities has been a factor responsible for this gradual improvement in cleaning facilities in the Southeastern states because the longer cottons are harder to clean than shorter ones and consequently require more effective cleaning equipment. A report given in Technical Bulletin No. 663, "Effect of Cleaning Seed Cotton on Lint Quality and Ginning Efficiency", by the staff of the U. S. Cotton Ginning Laboratory which was released in January 1939, covers extensive tests which deal with cleaning and extracting problems which are of major interest to the Southeastern states. The cleaning action of the extractor feeder was much greater than that of the huller front, while an overhead cleaner removed much less foreign matter than the extractor feeder. The huller stands proved to be desirable improvements, however, even when unit extractor feeders were used, and are being recommended.

A power survey made during 1938-39 by the staff of the Laboratory at 63 representative gins in the Mississippi Delta brought out some very interesting facts in regard to the power waste incurred through fans and piping. The survey indicated that fans and piping consumed approximately 40 percent of the total power used for ginning, and that this power ranged from 19 percent for efficient gins to 64 percent for inefficient ones. Separator leaks ranging from 17 percent to 60 percent of the air handled by the fan were shown, which is a significant item of waste, because the separator leaks do not perform any useful work. In one group of gins where the separator loss averaged 42.7 percent, the power required to operate the cotton suction fan was 27.6 horsepower for 4-stand outfits as compared to only 19.2 when the separator losses were reduced to 27.3 percent. In other words, a reduction of 15.4 percent in the leakage of the separator resulted in the direct saving of 8.4 horsepower. Suction pipe diameters across the entire Belt appear to be too large. In the Mississippi Delta the average for 3-stands is 11.7 inches when 10 inches should serve more economically; 12.3 inches for 4-stands when 11 inch suction pipe is recommended and 13 inches for 5-stands where 12 inch piping should be ample. The Ginning Laboratory recommends 9 to 10 inch suction piping for 3 stands, 10 to 11 inch for 4 and 11 to 12 inch for 5 stands. Seed blow piping with individual fans need not be larger than 10 or 11 inches in diameter.

The Laboratory studies in gin saw speeds have contributed to material profits for the ginners where older gins have increased their saw speeds within the range of 550 to 600 r.p.m. In making these changes the picker roller and feeder speeds are retained approximately at their original settings, along with constant brush speeds. Generally, an increase in saw speeds to between 550 and 600 r.p.m. should prove very gratifying in increased capacity and better ginning without materially affecting the power.

The general trend in design of cotton gin stands in both airblast and brush types seems to be nearing a saw speed of 700 r.p.m. as compared with about 400 r.p.m. for many types of gins manufactured prior to 1930. The higher speeds contribute immensely to loose roll operation. Reasonable increases in gin saw speeds thus not only provide for better quality lint but make it possible to clean seed better and improve gin turn-out without impairing spinning quality. It is not uncommon to find any type of these later models of gins operating between 600 r.p.m. and 700 r.p.m.

The first important element involved in good ginning is the necessity for having dry seed cotton, and the next is the factor of seed roll density. Loose seed roll operation is essential even with dry short staple cotton if smooth and superior preparation is to be obtained. There are a number of factors that influence seed roll density. First of these is the matter of feeding any gin, of any type or condition, beyond its normal capacity. This is about the only cause of dense roll operation with the newer designs of gins, while with the old gins that operate with slow speeds and have been neglected so far as repair of vital parts are concerned, satisfactory capacity can be attained only with a dense seed roll operation which causes rough preparation. Pre-ginning in the huller fronts may also result from heavy feeding. If the saws have been neglected, and are dull or badly worn they will not be efficient in removing lint from the seed and the result will be dense seed rolls which require greater power on the one hand and cause "napping" or poor preparation of lint on the other.

A Departmental release issued in August 1939, "Effects of Variations in Design of Gin Saw Teeth on Lint Quality and Ginning Efficiency", brings out the results of tests on 97 cottons and shows that 12 inch saws having 264 straight teeth or 280 to 290 modified roach teeth gave best results of all saws which the Laboratory had tested.

The reductions made in saw diameter of one-sixteenth of an inch by wear and sharpening caused appreciable losses in lint turn-out in spite of the readjustments made in breast and saw positions. Losses in ginning capacity can be appreciable unless the pitch angle of the teeth is gradually increased without weakening the teeth during periodic sharpenings made of gin saws. Roached teeth give less lint turn-out than straight teeth when new; but when the saws are reduced in diameter by several sharpenings, which cause the teeth to assume a straighter back, they do not show as much loss in turn-out as that produced by straight teeth similarly sharpened. In the light of our present knowledge, the reduction in diameter of 10 inch saws, even on plain gins, would lead to a decrease in turn-out and ginning

capacity, and thus cause tight seed roll when attempts are made to turn out as many bales per hour as when the saws were new.

There are other precautions to follow in operating the gin stands to assure good ginning. Proper adjustment of picker rollers, seed boards and mote boards are essential, and in brush gins the dividing boards and wind boards must be maintained in their proper positions and dimensions. The brush cylinder should have no end play and should be so set in relation to the saws that their bristles overlap the saws to the full depth of the teeth. It is not necessary to have a fixed ratio between the speed of the brush and that of the saws, but the brush should be operated only at a high enough speed to remove all the lint from the teeth and at the same time to create a strong enough air current to convey the ginned lint to the condenser. In airblast gins it is now becoming the practice to control the nozzle pressure by slide or cone valves placed on the intake of the fan so that higher pressures may be used as the moisture content of the cotton increases, and so that economical operation at doffing pressures of approximately 12 inches, as measured on a water gauge, can be maintained.

The lint flue air diversion valve should be set to give a uniform bat of lint from the condenser. There should be an adequate discharge of the air from the condenser to prevent back lash of the gins and irregular lint bats. The speed of the condenser should be slow enough to provide a fairly thick bat of lint to the press. To suit the condition of the cotton, the lint kicker speed should be varied or its position adjusted, and the lint slide position varied, the damper cottons requiring faster speed, or forward or lower adjustment of the kicker or higher position of the lint slide than the drier cottons. Attention to the units from lint flue to the press should go a long way toward preventing big-ended and big-sided or rolling bales, and the cutting of them at compresses.

In conclusion, I wish to say that Mr. Gerdes and I appreciate the invitations that you extend us each year to come to your meetings and discuss ginning problems with you; and we welcome a visit from you to the U. S. Cotton Ginning Laboratory at Stoneville especially when any of you contemplate making changes in your ginning facilities or further efforts toward modernization.